ORIGINAL ARTICLE

The impact of driver distraction on road safety: results from a representative survey in two Australian states

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Objective: To quantify the prevalence and effects of distracting activities while driving.
Design: Cross sectional driver survey.
Setting: New South Wales and Western Australia, Australia.
Participants: 1347 licensed drivers aged between 18 and 65 years. Data were weighted to reflect the corresponding driving population.
Main outcome measures: Prevalence of distracting activities while driving; perceived risks and adverse outcomes due to distractions.
Results: The most common distracting activities during the most recent driving trip were lack of concentration (weighted percentage (standard error, SE) 71.8% (1.4%) of drivers); adjusting in-vehicle equipment (68.7% (1.5%)); outside people, objects or events (57.8% (1.6%)); and talking to passengers (39.8% (1.6%)). On average, a driver engaged in a distracting activity once every six minutes. One in five crashes (21%) during the last three years, involving one in 20 drivers (5.0% (0.7%)), was attributed to driver distraction based on self-report. In the population under study, this equated to 242,188 (SE 34,417) drivers. Younger drivers (18–30 years) were significantly more likely to report distracting activities, to perceive distracting activities as less dangerous, and to have crashed as a result.
Conclusions: Distracting activities while driving are common and can result in driving errors. Driver distraction is an important cause of crashes. Further research is needed to estimate the risk conferred by different distracting activities and the circumstances during which activities pose greatest risk. These results suggest that a strategy to minimize distracting activities while driving, with a focus on young drivers, is indicated.

A driver distraction can be defined as any activity that diverts a driver's attention away from the task of driving.[1] Although it is clear that distractions may affect a driver's control of a vehicle, little is known about drivers' exposure to distracting activities while driving and the impact of that exposure on road safety. To begin, there is a lack of detailed and systematically collected information about the role of driver distraction in crashes among a representative group of drivers. Of the research that has been undertaken, some has been based on police reports of crashes.[2 3] However, information on driver distraction is likely to be underreported or differentially reported, with the latter dependent on factors such as the severity of the crash, the type of distracting activity and the jurisdiction within which the crash occurred. Other research has been experimental in nature, examining in-vehicle[4–8] and outside factors.[4 9] Although the findings of most of these studies have shown decrements in driving performance, translating findings from the laboratory into the real world is problematic.

In a novel development, two naturalistic driving studies have been conducted recently to assess exposure to, and the adverse consequences of, distracting activities.[10 11] These studies used cameras to monitor the behavior of drivers in their everyday driving. For example, Stutts and colleagues[10] recorded the distracting activities of 70 drivers using data from three hours of driving collected over a one-week period. All drivers undertook at least one type of distracting activity and, altogether, these drivers spent 14.5% of the total time their vehicles were in motion engaged in distracting activities, other than talking to passengers. Some types of distracting activities were associated with driving impairment, defined as eyes off the road, hands off the steering wheel, and lane drift. However, the limitations of naturalistic driving studies require consideration. They may include small, non-representative, volunteer samples;[10 11] limited number of recorded hours of driving;[10] low interrater reliability in coding distracting activities (65–70% in Stutts *et al*[10]); difficulties in distinguishing near crashes from incidents;[11] an inability to capture drivers' level of cognitive attention;[10 11] and problems in extrapolating driving impairment into crash risk.[10]

How often a distracting activity will result in a crash will be a function of several factors: the proportion of the drivers who engage in the activity, the frequency and duration of time those drivers spend on it, and the relative risk conferred by it. We conducted a representative survey of drivers in two Australian states to explore some of these factors. This study was unique in several respects. First, we systematically quantified the frequency, and types, of distracting activities drivers engaged in during their most recent driving trip. Second, we measured the adverse consequences resulting from distracting activities, including the role of driver distraction in crashes occurring in the preceding three years and the types of crashes that ensued. Accordingly, the survey provides estimates of the prevalence of distracting activities while driving and the extent to which driver distraction adversely affects road safety.

Abbreviations: BAC, blood alcohol concentration; DPI, Department of Planning and Infrastructure (Western Australia); IQR, interquartile range; NSW, New South Wales; Pop est, Population estimate; RTA, Roads and Traffic Authority (New South Wales); UWA, The University of Western Australia; WA, Western Australia.

METHODS

Study population

The survey was conducted in New South Wales (NSW) and Western Australia (WA). Both states have capital cities (Sydney and Perth, respectively), regional centers, and rural areas. Participants were required to hold a driver's licence, be aged between 18 and 65 years, reside in either NSW or WA, have driven in the last month, and mainly drive a motorized vehicle other than a motorcycle on public roads. Based on data from the NSW Roads and Traffic Authority (RTA) and the WA Department of Planning and Infrastructure (DPI), the population of this group was 4.9 million in July 2003.

Sample selection

The sampling frame was the residential section of the Electronic White Pages in NSW and WA (Brylar's *Australia on Disc Residential*, May 2003). Households were stratified by state of residence and area of residence as defined by postcode data. Four pools of phone numbers were randomly selected (comprising Sydney, regional NSW, Perth, and regional WA). Individuals were stratified on the basis of age group (18–30, 31–49, and 50–65 years) and sex. Small groups (for example, regional residents) were oversampled and the overall sample size was calculated to take into account the stratification and powered to detect distracting activities with a prevalence of at least 10% ($p = 0.05$, precision = 0.05).

Survey questionnaire

The questionnaire contained items to ascertain the demographic and driving characteristics of respondents, the frequency of distracting activities during the most recent driving trip, their effects as measured by driving errors, and the perceived risk of crash attributable to certain risk taking habits including distracting activities. Identifying data, such as name and date of birth, were not obtained. We collected information on numerous types of activities such as viewing outside objects, people and events; talking to passengers; adjusting, or reaching for, in-vehicle equipment or objects; and daydreaming. We also collected data on crashes in the last three years including when the crash had occurred (month and year), details about the crash event, whether the crash was the result of a distraction, what the distraction had been and how it had contributed to the crash.

Survey conduct

Telephone interviews were conducted between 20 October 2003 and 7 November 2003 by trained professional interviewers in the Survey Research Centre at The University of Western Australia (UWA). Up to eight calls were made to each residential number, with calls made at various times of the day and days of the week to increase the likelihood of making contact. Once contact was established, the interviewer provided an explanation for the call and determined the eligibility of household members for the survey. If multiple household members were eligible, the individual with the most recent birthday was interviewed. A computer assisted telephone interview system was used to manage call-backs and to enter and check data to allow only valid responses, such as within-range replies. Automatic rotation of response categories to minimize response bias was used where relevant. The Human Research Ethics Committees at UWA and The University of New South Wales approved the study.

Table 1 Survey response

	New South Wales	Western Australia
Screened out*	789	582
Respondents	676	671
Refusals		
Household	439	352
Respondent	385	236
Passive refusal†	6	14
Terminations‡	3	5
Total	1509	1278

*Ineligible individuals (no driver's licence; motorcycle riders; outside the age range; English language difficulties).
†Eight calls to a household without establishing contact.
‡Interview started but terminated before completion.

Table 2 Demographic profile

Factor	Observations	Weighted % (SE*)
Sex		
Male	686	51.9
Female	661	48.1
State of residence		
New South Wales	676	76.1
Western Australia	671	23.9
Place of residence		
Metropolitan	672	60.7
Regional	675	39.3
Age group (years)		
18–30	440	26.2
31–49	465	46.3
50–65	442	27.5
Employment		
Full time	692	53.2 (1.4)
Part time	242	18.4 (1.2)
Retired	118	8.0 (0.8)
Student	90	6.6 (0.7)
Homemaker	127	8.6 (0.9)
Other	78	5.2 (0.7)
Education		
To Year 6	7	0.4 (0.2)
To Year 8	47	3.1 (0.5)
To Year 10	300	18.8 (1.2)
To Year 12	299	21.0 (1.3)
College certificate	313	23.5 (1.4)
University degree	350	31.2 (1.5)
Other	31	2.0 (0.5)

*Where applicable.

Survey analysis

The total numbers of licensed drivers in each of the 24 strata were obtained from the RTA and the DPI. These were used to calculate the appropriate weightings so as to produce population estimates (pop est; and their standard errors, SE). There were no statistically significant differences between the states for the key measures, including the frequency and types of distracting activities reported during the most recent driving trip and the proportion of drivers who had crashed in the last three years. Accordingly, the data were pooled and the study population was defined as the population of drivers aged between 18 and 65 years in the states of NSW and WA.

The data were analyzed in STATA Version 8. Percentages are presented as weighted percentages (SE), unless otherwise stated. In certain circumstances, for example, when the denominator was not drivers but incidents or crashes, unweighted percentages are shown. Frequencies and proportions were calculated for categorical data and means, medians, and interquartile ranges (IQR) for continuous data. Pearson's correlations were calculated for continuous data following data transformation to approximate normality, if necessary. Weighted univariate χ^2 tests and weighted χ^2 tests for linear trend were used for categorical data. Multiple logistic regression was undertaken to determine if there were significant differences in the frequency of reported distracting activities by sex, age group, and area of residence, after

Table 3 Experience and driving pattern

Factor	Observations	Weighted %* (SE)
Routine driving pattern	936	71.6 (1.4)
Distance driven (km/year)		
<2000	75	6.0 (0.8)
2000–4999	190	14.2 (1.1)
5000–9999	213	16.4 (1.2)
10,000–19,999	363	27.7 (1.5)
⩾20,000	506	35.8 (1.5)
Average driving frequency		
Once a week or less	21	2.0 (0.5)
Two to three days per week	92	7.1 (0.8)
Four to six days per week	170	12.2 (1.0)
Daily	1064	78.6 (1.3)
Primary location of driving		
Mainly metropolitan	715	63.7 (0.9)
Mainly regional centers	355	22.1 (1.0)
Mainly rural (open road driving)	277	14.2 (0.9)
Presence of passengers		
Rarely or never	308	22.0 (1.3)
During about a quarter of trips	350	26.0 (1.4)
During about half of trips	233	18.2 (1.3)
During about three quarters of trips	131	9.3 (0.9)
On all or most trips	325	24.4 (1.3)
Time driven on an average day (min)		
⩽30	305	20.5 (1.3)
31–60	480	36.3 (1.6)
61–120	355	26.7 (1.4)
>120	207	16.4 (1.2)

*Weighted percentages may not add up to 100% due to rounding effect.

adjusting for length of trip and, where relevant, for presence of passengers. The Friedman and Wilcoxon signed rank tests were used to establish whether there were significant differences in the way drivers' perceived the level of risk conferred by different risk taking habits (each expressed on a five-point ordinal scale, where 1 equalled no increase in risk of crash and 5 equalled extremely high increase in risk of crash).

RESULTS

There were 1347 respondents across the two states. The overall response rate was 48.3% (1347/2787; NSW 44.8%; WA 52.5%). Table 1 shows the breakdown of screened households and individuals. The demographic and driving characteristics are summarized in tables 2 and 3. The median time spent driving on a typical day was 60 minutes (IQR 40–120 minutes). The majority had driven in the three days prior to interview (1309, weighted percentage (SE) 97.0% (0.5%)).

Table 4 Types of distracting activities reported during the most recent driving trip of five minutes' or more duration

Distracting factor	Observations	Weighted % (SE)
Lack of concentration†	953	71.8 (1.4)
Outside person, object, or event	764	57.8 (1.6)
Talking to passengers	522	39.8 (1.6)
Adjusting the stereo	519	40.1 (1.6)
Adjusting the air conditioner	357	28.3 (1.5)
Adjusting other in-vehicle equipment	577	44.3 (1.6)
Reaching for objects in the vehicle	295	23.1 (1.4)
Drinking	162	11.3 (1.0)
Eating	79	6.0 (0.8)
Smoking	137	10.6 (1.0)
Personal grooming	43	3.5 (0.6)
Mobile phone use	98	9.0 (1.0)
Lost, seeking directions	26	1.9 (0.4)
Reading a map	21	1.6 (0.4)
Reading (other than road signs and maps)	10	0.8 (0.3)
Other‡	138	9.9 (1.0)

†Lack of concentration includes thinking about other things and daydreaming.
‡"Other" included sneezing, coughing, and dealing with insects in the vehicle. Accessing email and use of a personal organiser were excluded (see text).

Distracting activities during the most recent driving trip

The most common distracting activities reported by drivers during the most recent driving trip of ⩾5 minutes' duration were lack of concentration (71.8% (1.4%) of drivers; pop est. (SE) 3,494,335 (69,880)), adjusting in-vehicle equipment (68.7% (1.5%); 3,344,526 (69,880)), viewing outside people, objects, or events (57.8% (1.6%); 2,812,114 (76,229)) and talking to passengers (39.8% (1.6%); 1,938,505 (76,429); table 4). In relation to new technologies, very few drivers used an electronic organiser (three drivers) or accessed email (one driver) while driving. The number of different types of distracting activities was positively correlated with the trip's duration (Pearson correlation 0.35, $p<0.001$). On average, a driver was engaged in some type of distracting activity once every six minutes while driving.

Younger drivers were significantly more likely to report a number of distracting activities including lack of concentration (18–49 years: 75.7% *v* 50–65 years: 61.5%, $p<0.001$); adjusting in-vehicle equipment (18–30 years: 80.8%, 31–49 years: 70.0%, 50–65 years: 54.9%, $p<0.001$); outside distractions (18–30 years: 72.5%, 31–49 years: 62.1%, 50–65 years: 45.9%, $p<0.001$); and mobile phone use (18–49 years: 11.0% *v* 50–65 years: 4.1%, $p = 0.004$). Males were more likely to report outside distractions (65.7% *v* 54.9%, $p<0.001$) and mobile phone use (11.8% *v* 5.9%, $p = 0.002$) than females, though females were more likely to report talking to passengers (44.3% *v* 35.7%, $p = 0.007$). Metropolitan residents were more likely to report outside distractions (64.0% *v* 55.2%, $p = 0.006$) and mobile phone use (10.5% *v* 6.6%, $p = 0.03$) than rural residents. The associations remained significant after adjusting for the length of the trip. However, after adjusting for the presence of passengers, females were no more likely to talk to passengers than males.

Table 5 Drivers' perception of the increase in crash risk conferred by various distracting and other risk behaviors (listed in rank order from most to least dangerous)

		Crash risk (weighted %* by row (SE))				
Risk taking habit†	n‡	No increase	Small increase	Moderate increase	High increase	Extreme increase
Writing and sending a text message	1314	0.3 (0.2)	1.8 (0.4)	9.7 (0.9)	33.7 (1.6)	54.5 (1.6)
BAC 0.08 g/dl	1296	0.9 (0.3)	3.6 (0.6)	13.4 (1.1)	34.0 (1.6)	48.1 (1.6)
Reaching for object on backseat	1339	0.5 (0.2)	4.2 (0.7)	17.4 (1.2)	42.4 (1.6)	35.5 (1.5)
Reading a map	1339	1.0 (0.4)	4.1 (0.6)	25.4 (1.4)	43.6 (1.6)	25.9 (1.4)
Handheld mobile phone use	1326	1.5 (0.4)	7.0 (0.8)	21.6 (1.3)	38.2 (1.6)	31.7 (1.5)
80 km/h in 60 km/h zone	1332	3.5 (0.6)	8.8 (0.9)	30.4 (1.5)	38.8 (1.6)	18.5 (1.2)
BAC 0.05 g/dl	1293	5.0 (0.7)	10.8 (1.0)	24.3 (1.4)	30.5 (1.5)	29.4 (1.5)
Daydreaming	1337	5.3 (0.8)	20.3 (1.3)	38.1 (1.6)	27.2 (1.4)	9.1 (0.9)
Driving continuously for >2 hours	1338	12.6 (1.0)	15.2 (1.1)	39.4 (1.6)	24.5 (1.4)	8.3 (0.9)
Observing scenery	1344	12.4 (1.1)	26.6 (1.4)	44.0 (1.6)	14.7 (1.1)	2.3 (0.5)
Hands-free mobile phone use	1311	14.7 (1.2)	30.0 (1.5)	39.6 (1.6)	11.2 (1.0)	4.4 (0.7)
Talking to passengers	1344	30.7 (1.5)	38.7 (1.6)	27.6 (1.5)	2.3 (0.5)	0.7 (0.3)

*The row sums of weighted percentages may not add to 100% due to rounding.
†Respondents were asked to estimate crash risk while vehicle was in motion. The list of risk taking habits was randomised for each respondent at the time of interview.
‡Number responding; remainder are ''Don't know''.
BAC: blood alcohol concentration.

In the most recent driving trip, 294 adverse incidents occurred among 252 drivers. Forty seven drivers (3.4% (0.6%)) reported having to swerve to avoid a collision, 153 drivers (11.3% (1.0%)) had to brake suddenly, three drivers (0.2% (0.2%)) missed a stop sign, four drivers (0.5% (0.3%)) ran a red light, and 87 drivers (6.0% (0.8%)) reported another driving incident, such as lane drift, wrong turns, missed turns, and hitting objects or the kerb. A distraction was reportedly the cause of 50 driving errors (17%; unweighted) among 49 drivers. This suggests that 163,374 drivers (28,472) in the study population will have experienced a driving error due to a distraction during their most recent driving trip of $\geqslant$5 minutes. The most common types of distraction that led to these errors were outside objects, people or events (22 incidents), lack of concentration (11), and passengers (6).

Perceived risks

Some distracting activities were not perceived to pose a serious threat to a driver's ability to control a vehicle. For example, seven in 10 drivers did not consider talking to passengers as dangerous (table 5). However, nine in 10 drivers felt that writing text messages while driving was very dangerous (high or extreme risk). There was a significant difference in the perceived risk of a crash by rank order from most to least dangerous risk taking habit (Friedman test, $p<0.001$). Moreover, writing text messages was judged to be significantly more dangerous than the next most dangerous risk taking habit: driving with a blood alcohol concentration (BAC) of 0.08 g/dl (Wilcoxon signed rank test, $p<0.01$).

Younger drivers (18–30 years) rated most distracting activities as significantly less risky compared with their older counterparts. These activities included using mobile phones (handheld and hands-free), writing text messages, reading maps, reaching for backseat objects, and viewing scenery (all $p\leqslant0.03$). For example, in relation to writing text messages while driving, 37.3% of 18–30 year old drivers, 55.9% of 31–49 year old drivers, and 69.0% of 50–65 year old drivers felt that this was extremely risky. Males rated most risk taking habits as significantly less risky compared with females (all $p\leqslant0.03$), except for reaching for backseat objects ($p=0.15$) and daydreaming ($p=0.17$), where there was no significant difference by sex.

Crashes resulting from self-reported distractions

There were 313 crashes among 266 drivers (20.1% (1.3%)) during the preceding three years. Sixty six drivers (5.0% (0.7%)) attributed one of their crashes to being distracted (21% of reported crashes; unweighted). This suggests that almost one quarter of a million drivers (242,188 (34,417)) in the study population will have had a crash due to a distraction in the last three years. The types of distractions that were reported were lack of concentration (28, 42% of all distraction related crashes; unweighted); outside objects, people, or events (18, 27%); talking to passengers (7, 11%); adjusting in-vehicle equipment (3, 5%); and other distractions (10, 15%). The major types of crashes that were reported by these drivers were rear-end collisions (27 crashes, 41%; 24 of which involved the driver's vehicle hitting the vehicle in front), crashes while reversing (12, 18%), crashes due to loss of vehicular control by the driver (9 crashes, 14%), and crashes due to the driver failing to stop at an intersection (7 crashes, 11%). Younger drivers were significantly more likely to report a crash due to a distraction than older drivers (18–30 years: 7.7%, 31–49 years: 5.0%, 50–65 years: 2.3%, $p=0.01$). There were no significant differences on the basis of sex, area or state of residence, and driving frequency.

DISCUSSION

Our survey is one of the few worldwide to have examined the issue of driver distraction beyond the use of mobile phones while driving. Distracting activities while driving are highly prevalent. In the most recent driving trip, most drivers will have talked to passengers; adjusted in-vehicle equipment; reached for objects in the vehicle; or viewed people, objects, or events outside the immediate road environment. In the study population, we have estimated that 1.9 to 3.5 million drivers will experience at least one of the four most common types of distracting activity during a trip lasting five minutes or more. On average, a driver will engage in a distracting activity once every six minutes and, although the time spent on each activity may vary, exposure to distracting activities while driving is substantial.

Furthermore, distracting activities can result in adverse outcomes. Of all driver errors, 17% were attributed to driver distraction in our survey. We estimate that over 160,000 drivers in the study population will experience an error due to a distraction on any given trip of five minutes or more. Almost a quarter of a million drivers (5% of the driving population) are expected to have crashed while distracted in the last three years, and 21% of all crashes were due to driver distraction on the basis of self-report. Younger drivers were significantly more likely to report distracting activities while

Drivers were found to be engaged in some type of distracting activity once every six minutes while driving.

driving, to perceive distracting activities as less dangerous, and to have had a crash due to a distraction. The latter association is supported by evidence from an American survey.[12]

A review of police reported crashes between 1995 and 1999 in the American Crashworthiness Data System (CDS) revealed that 8.3% of drivers were distracted at the time of their crash.[2] Outside objects, persons, and events (29.4% of distracted drivers); adjusting in-vehicle audio equipment (11.4%); and passengers (10.9%) were the three distractions most often cited. However, the drivers' attention status was unknown in 35.9% of drivers, so the proportion of drivers distracted at the time of crash is almost certainly underestimated. In New Zealand, driver distraction was involved in at least 9.5% of police reported crashes during 2002 and 2003, with outside- and inside-vehicle factors recorded approximately equally.[3] Although crash data can provide information on the relative contributions of different types of distracting activities, risk estimates cannot be calculated because of a lack of exposure data.

We recently published a case crossover study which showed that drivers' use of a mobile phone up to 10 minutes before a crash was associated with a fourfold increase in the likelihood of having a serious crash.[13] However, the risks associated with other driver distractions remain unclear. The use of a case crossover design to examine other distracting activities has been limited by the inability to validate self-report about such activities before a crash and during equivalent control intervals. This is distinct from data about mobile phone use which can be cross referenced to phone company records. Establishing risk estimates for the gamut of distracting activities that occur while driving is an important area for research. Moreover, investigation into the circumstances during which distracting activities present the greatest risk is also warranted. In the naturalistic driving study conducted by Stutts and colleagues,[10] drivers were more likely to carry out distracting activities while a vehicle was stationary suggesting some discriminating capacity among drivers to choose safer periods.

A number of limitations should be noted. First, random digit dialling was not undertaken because it represented a more costly and less efficient method. Instead phone numbers were randomly selected from the residential Electronic White Pages, thus respondents were sampled only from those households with a landline and a phone book listing. Notably, there is evidence to suggest that using the Electronic White Pages as the sampling frame for health surveys does not introduce significant bias into health estimates.[14] Second, the survey's response rate approached 50% and the possibility of selection bias needs consideration. However, as almost all drivers have engaged in distracting activities while driving, it is unlikely that differential bias between respondents and non-respondents would have had an appreciable effect. Third, self-reported data may be subject to recall and social desirability bias. Reassuringly, in a study conducted among a cohort of young drivers in New Zealand, there was a high level of agreement between self-reported crash details and police records.[15] Social desirability has not been shown to significantly influence self-reported driver behavior, particularly in an anonymous setting such as the one we used.[16 17] It is possible that there may have been some differential bias on the basis of factors such as age and sex. Importantly, any resultant bias would tend to underestimate the extent of the problem of driver distraction rather than overestimate it.

Implications for prevention

Our survey has provided valuable data on drivers' exposure to distracting activities and the adverse outcomes that can result. While further research is needed to estimate the risk conferred by different activities and the circumstances during which these activities pose greatest risk, we believe that a strategy to minimize distracting activities while driving, with a focus on young drivers, is indicated in the meantime. Components of the strategy should include driver education to raise awareness about the impact of driver distraction through the media and in learner handbooks; enforcement of existing laws including those that require a driver to maintain control of their vehicles; systematic recording of the presence and types of distraction contributing to police reported crashes for surveillance purposes; continued efforts by motor vehicle manufacturers to develop early warning systems to prevent collisions that may result from driver distraction; and thorough assessment of the safety aspects of novel in-vehicle technologies.

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Key points

- Driver distraction is an important cause of crashes and a range of activities can contribute.
- Younger drivers are more likely to report distracting activities while driving, to perceive distracting activities as less dangerous, and to have crashed as a result of a distraction.
- As drivers' exposure to distracting activities is high, policies that include education and innovative enforcement practices will be needed to decrease the prevalence of these activities and reduce adverse outcomes.

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REFERENCES

1 **Ranney TA**, Garrott WR, Goodman MJ. NHTSA driver distraction research: past, present and future. 17th International Technical Conference on the Enhanced Safety of Vehicles. Amsterdam, June, 2001.
2 **Stutts JC**, Reinfurt DW, Rodgman EA. The role of driver distraction in crashes: an analysis of 1995–1999 Crashworthiness Data System Data. *Annu Proc Assoc Adv Automot Med* 2001;**45**:287–301.
3 **Gordon C**. What do police reported crashes tell us about driver distraction in New Zealand? Australasian Road Safety Research Policing Education Conference. Wellington NZ, 2005.
4 **Horberry T**, Anderson J, Regan MA, *et al*. Driver distraction: The effects of concurrent in-vehicle tasks, road environment complexity and age on driving performance. *Accid Anal Prev* 2006;**38**:185–91.
5 **Amado S**, Ulupinar P. The effects of conversation on attention and peripheral detection: is talking with a passenger and talking on the cell phone different? *Transport Res F* 2005;**8**:383–95.
6 **Lansdown TC**, Brook-Carter N, Kersloot T. Distraction from multiple in-vehicle secondary tasks: vehicle performance and mental workload implications. *Ergonomics* 2004;**47**:91–104.
7 **Brodsky W**. The effects of music tempo on simulated driving performance and vehicular control. *Transport Res F* 2002;**4**:219–41.
8 **Burns PC**, Parkes A, Burton S, *et al*. How dangerous is driving with a mobile phone? Benchmarking the impairment to alcohol. TRL Report 547. TRL Ltd, 2002.
9 **Crundall D**, Van Loon E, Underwood G. Attraction and distraction of attention with roadside advertisements. *Accid Anal Prev* 2006;**38**:671–7.
10 **Stutts JC**, Feaganes J, Reinfurt D, *et al*. Driver's exposure to distraction in their natural driving environment. *Accid Anal Prev* 2005;**37**:1093–101.
11 **Neale VL**, Dingus TA, Klauer SG, *et al*. An overview of the 100-car naturalistic driving study and findings. 19th International Technical Conference on Enhanced Safety of Vehicles, Washington DC, June, 2005.
12 **Royal D**. National survey of distracted and drowsy driving attitudes and behaviours, 2002. The Gallup Organization. Volumes I and III. Prepared for the National Highway Traffic Safety Administration, March, 2003.
13 **McEvoy SP**, Stevenson MR, McCartt AT, *et al*. Role of mobile phones in motor vehicle crashes resulting in hospital attendance: a case-crossover study. *BMJ*. doi: 10, 1136/bmj.38537.397512.55, 2005;**331**:428–30.
14 **Wilson DH**, Starr GJ, Taylor AW, *et al*. Random digit dialling and Electronic White Pages samples compared: demographic profiles and health estimates. *Aust N Z J Pub Health* 1999;**23**:627–33.
15 **Begg DJ**, Langley JD, Williams SM. Validity of self reported crashes and injuries in a longitudinal study of young adults. *Inj Prev* 1999;**5**:142–4.
16 **Lajunen T**, Summala H. Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses. *Transport Res F* 2003;**6**:97–107.
17 **Hatakka M**, Keskinen E, Katila A, *et al*. Self-reported driving habits are valid predictors of violations and accidents. In: Rothengatter T, Carbonell Vaya E (eds). *Traffic and transport psychology: theory and application*. Oxford, UK: Pergamon, 1997:295–303.